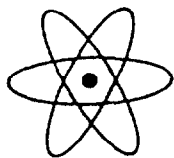


GENIUS IN THE SHADOWS

A Biography of Leo Szilard



The Man Behind the Bomb

WILLIAM LANOUE

WITH BELA SZILARD

Foreword by JONAS SALK

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excerpts re Lederberg.

soaked from a spring downpour, Szilard took the girl's hand. "You come with me," he said, flashing an avuncular grin as he led her to his biology laboratory and stood her in front of a hot-air vent to dry.⁷

Away from Chicago, Szilard hired stenographers wherever he stopped: scribbling notes on planes and trains, dictating letters and article drafts in paper-strewn hotel rooms, then "filing" his papers in small suitcases that he bought in transit and stashed in friends' and relatives' closets.⁸ Yet from this frantic thought and motion came some original results. Szilard helped to frame the emerging field of molecular biology by arranging informal fortnightly seminars around the Midwest with Joshua Lederberg, James Watson, and Salvador Luria as a way to speed information exchange in a rapidly developing field. And he drafted plans for a research center that addressed both scientific and social concerns (eventually realized as the Salk Institute for Biological Studies), his way to foster the blend of reason and imagination that energized his own restless life. Also, Szilard helped create new forums for arms control, such as the Pugwash Conferences on Science and World Affairs.

As in the past, Szilard pursued his urgent activities by working mainly alone; publicly in the shadows of science and world affairs, privately in the contours of his potent and playful mind. And, as in the past, this fumbling genius amused, annoyed, and bewildered the very people he tried to help and who, in turn, might have helped him stabilize his vagabond life. He enjoyed generating ideas that people in power might use and spouted advice to anyone who would listen. But he shunned the commitments and perseverance needed to join and flourish in the scientific and foreign policy "establishment."

Indeed, Szilard's quirky and creative life left many who knew him wondering if he were serious—a question he sometimes had to ask himself. On a live, nationally broadcast radio discussion about the hydrogen bomb in 1950, he stunned fellow scientists Hans Bethe, Harrison Brown, and Frederick Seitz by proposing that the new weapon—if built—should be made so dreadful that no nation would dare use it. His proposal led to the idea of the cobalt bomb, later a model for the doomsday machine in the film *Doctor Strangelove*.⁹

Often lonely and forlorn, Szilard gradually began to appreciate after the war the uses and pleasures of sociability. Shy behind his bombastic quips and wisecracks, Szilard savored the friendly lunchtime conversations at the round tables in the Quadrangle Club's dining room, yet often returned there to eat his dinner alone: reading, scribbling notes, or simply staring across the huge, dark room. Even when dining with friends, he

and thought. And thought. Once in a while he scribbled a note. More often, he simply let his mind wander, opening and closing his eyes as he seized ideas and wrung from them every consequence and conclusion he could find. As the sunlight faded, Szilard returned the chair to the kitchen, thanked Mrs. Levi, and walked back to the club for dinner.²⁵

One of the first experiments Szilard and Novick undertook was to clarify a difference of opinion between Delbrück and Luria, on the one hand, and geneticist Joshua Lederberg, on the other. Lederberg's experiments had led him to conclude that mating, or "genetic recombination," occurred in bacteria. Szilard and Novick designed what they considered to be a decisive test and sided with Lederberg. "I'll eat my hat if this isn't genetic recombination," Szilard wrote to Delbrück and Luria when describing their results. Luria agreed with Szilard, but Delbrück urged them to do more work. When they learned that Lederberg had already made an equivalent test, and discovered his results in a table listing several experiments, Szilard and Novick dropped this work and turned to a puzzling paradox that Delbrück had reported at the 1947 Cold Spring Harbor course.

Paradoxes fascinated Szilard because he considered them clues to defects in our understanding of the world, and this one led Szilard and Novick to discover a new phenomenon that came to be called phenotypic mixing. They found that if they infect bacteria with closely related viruses, such as the common T2 and T4 strains, some T2 viruses acquire the appearance (phenotype) of T4 viruses, but they remain genetically (in genotype) T2 and subsequently yield only T2 progeny. While in the anomalous stage, T2 viruses behave as if they were T4, in that they can infect bacteria normally resistant to T2, but their progeny cannot.²⁶

Still intrigued with Monod's finding that bacteria choose which sugars they metabolize, Szilard speculated about this process in 1948 as he headed west for a vacation with Trude Weiss at the Stead Ranch in Estes Park, Colorado. Unlike most people, Szilard used his mountain vacations not to escape work but to pursue his thoughts even harder. "A mild anoxia" from the thin air, Szilard thought, made him dizzy with fresh ideas, which he caught like butterflies and scribbled on notepads wherever he happened to be.²⁷ "While he worked, he could not be disturbed at all," an acquaintance who met him in Estes Park recalled.²⁸

From the Rockies, Szilard visited the Hopkins Marine Station at Pacific Grove, on California's Monterey Peninsula, where he joined Novick for a microbiology course given each summer by Stanford microbiologist Cornelius B. Van Niel. In letters to Trude in New York, Szilard raved

result seemed to offer a surprise. He was simply too anxious for answers. New ideas crowded out the old, and happily so. "The most important property of a man's brain," Szilard told John Platt, "is the ability to forget things."⁴¹

Besides Szilard's constant urge to plunge into new pursuits without finishing work at hand, Novick said that "lack of time or bad luck" kept them from fully developing many ideas. But Monod thought that Szilard's creative nature itself kept him from performing decisive work. Had Szilard relentlessly pursued just a few of his ideas, Monod wrote, "his own specific achievements—written-up, formalized, and stamped—might have *appeared* greater, more definitely significant. Then however he would have been just as good, but no better, than many other highly distinguished scientists.

"Szilard was different," Monod concluded. "He knew that meaningful ideas are more important than any ego, and he lived according to these ethics." He was "a man to whom science was much more than a profession, or even an avocation" but "a mode of being."⁴² Immunologist Melvin Cohn saw Szilard as a scientist more interested in discovering "how it might have worked than how it does work."

This mode of being also prompted Szilard to bend and break scientific conventions. His behavior fell outside the dichotomy that says science moves by evolution or by revolution. For Szilard, science advanced by subversion, by rigorous challenge to every discipline's most basic tenets, and by personal actions and reactions to ideas and events as they occurred. In Berlin, when he had seen Hermann Mark's modern X-ray equipment for studying fibers in 1923, Szilard decided they were better used to study the X rays themselves. At Cold Spring Harbor, when Szilard couldn't keep bacteria at the right temperature and its gelatinous, agar-based medium solidified, he twisted the experiment into a study of agar and its properties. And, in Chicago, when impatient with the delays in peer-reviewed scientific journals, he bypassed them entirely by arranging regular meetings with the researchers he considered expert in particular topics.

In 1949 and 1950, Szilard organized the Midwest Phage, Marching, and Chowder Society, fortnightly brainstorming sessions at universities in Madison, Chicago, Urbana, Bloomington, and Saint Louis. A grant from the Rockefeller Foundation covered travel and meals, and Szilard used the encounters to question and challenge researchers at the forefront of molecular biology. Scientists described and discussed their latest results during these informal sessions, always under Szilard's feisty interrogation. Besides Szilard, Novick, and cosponsor Salvador Luria, the meetings

included Alfred Hershey, Leonard Lerman, James Watson, Joshua and Esther Lederberg, Max Delbrück, Theodore Puck, Sol Spiegelman, Joe Bertani, Roger Stanier, Renato Dulbecco, and Bernard Davis.

Because Szilard relished the give-and-take of informal discussion, most of his ideas were carried away and tested by others or simply forgotten. But a few thoughts intrigued Szilard so strongly that he pondered them for years. One was his attempts to understand the aging process in all living things, and for this he developed the concept of "aging hits." In short, the number of chromosome defects that determine the natural length of life is set at birth.⁴³

As with many of his ideas, Szilard merged fact and fiction in his brainstorming, and his fictional "Mark Gable Foundation," written in 1948, described how people age and how those with incurable illness might be preserved cryogenically and revived for corrective treatment decades or centuries later. In 1955, Szilard wrote "Process for Slowing the Aging of Man," in which he argued—this time, seriously—that life expectancy could be extended for persons with incurable diseases by alternating long states of low-temperature sleep with shorter periods of active living, since, when frozen, their body functions, including aging, are suspended.⁴⁴ In this way, Szilard argued, a forty-year-old man with an incurable disease and only five years to live might choose to sleep nine months a year and live with his family for three, sharing his children's development to adulthood.

In 1958, Szilard worked intensively on drafts of a paper on aging, proposing that aging hits determine our life span and that these occur randomly to deactivate chromosomes over time. "Thus, in its crudest form," Szilard explained, "the theory postulates that the age at death is uniquely determined by the genetic makeup of the individual . . . [and] the main reason why some adults live shorter lives and others live long is the difference in the number of faults they inherit."⁴⁵ The *New Scientist* magazine published an account of Szilard's aging paper, and *Newsweek* concluded from it that "females live longer because they receive a perfect 15,000 genes while men receive fewer . . . [and that] increased atmospheric radiation will make people of the future look older than they are."⁴⁶

In biology, as in physics, Szilard continued his practice of taking out patents: for a "Process for Producing Microbial Metabolites," for the chemostat, for "Caffeine-Containing Products and Method of Their Preparation," and for cheese made with unsaturated fats—an early form of "lite" dairy products.⁴⁷ With Monod, Cohn, and Novick, Szilard developed a process for the industrial cultivation of microorganisms, based on

Mexico," Szilard said. But she worried about sanitation there and Leo's recurrent infections.

"Geneva," Szilard finally said. "Let's go to Geneva. You always liked Geneva." Trude telephoned Lisbeth Bamberger, who had become a "gal Friday" for the council. When she arrived, Szilard said, "Come with us! You have to have the courage to leave when you recognize the time has come." Bamberger telephoned airlines and travel agents for Trude and helped the Szilards pack, but finally decided to stay.⁴³

It was Szilard's habit to pay whenever he invited someone to a meal, but at lunch with Raskin that frantic Tuesday, October 23, he said, "Today we go Dutch." Szilard said he needed "all the cash on hand I can get." He advised Raskin to always be prepared in three ways: keep your passport in order, keep plenty of cash, and always keep a bag packed. (One bag Szilard always kept was his "Big Bomb Suitcase," with essential family, academic, and patent records, in case he had to flee a nuclear war.) "I will take Erika with me if you want," Szilard said, referring to Raskin's three-year-old daughter, whom he enjoyed entertaining on Sunday walks. Raskin admired Szilard and began to wonder what to do. Was this advice right? Should he flee, too?⁴⁴

The Szilards littered their room with new suitcases and packed until after midnight. Before dawn the next morning they stuffed fourteen bags into a taxi to National Airport and from there flew to New York. That Wednesday, October 24, as about twenty-five Soviet-bloc vessels steamed toward Cuba, the U.S. Navy closed its blockade around the island. Then the Soviets recalled some ships.

But as the White House redefined its quarantine procedures, a new problem arose in Washington, this time over the U.S. Navy's own conduct. The White House planners now wanted to be sure that the blockade did not humiliate the Russians. Otherwise, "Khrushchev might react in a nuclear spasm. . . ."⁴⁵ Just the irrational blunder Szilard had feared.

All day Szilard telephoned friends, urging them to leave, asking their opinions. He called geneticist Joshua Lederberg and in an anxious voice asked him what he thought he would do. He also called Richard Garwin, an H-bomb designer on the President's Science Advisory Committee, and the two physicists met for lunch at a small East Side restaurant. Even in panic, Szilard strained to be rational about the few facts they knew. "Leo maintained that the Soviets would not put offensive nuclear missiles in Cuba because they had nothing to gain," Garwin recalled. "And I said they would because they had nothing to lose." As it turned out, "we were both wrong," Garwin reflected years later. "They did put them in, which made Leo wrong, and they did have much to lose, which made me